



# Bituminous Update

## 2020 Metro State Aid Construction Seminar

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& Deb Evans (Mix Design Specialist)

February 12, 2020

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# Plant Mixed Asphalt Specifications

- 2360 Specification
- 3139 Graded Aggregate for Bituminous
- 3151 Bituminous Material
- 2357 Tack Spec
- 2399 Pavement Smoothness

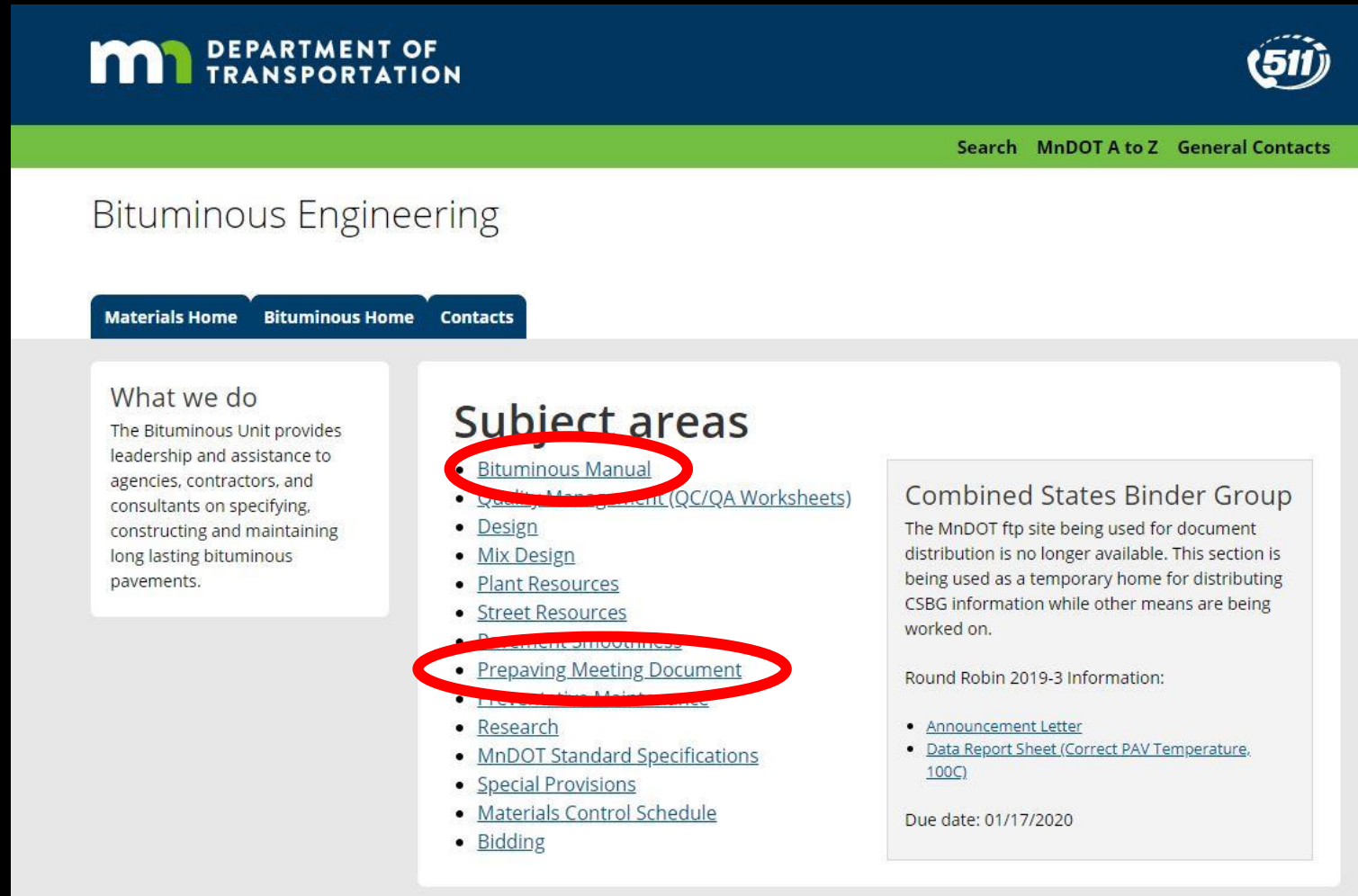


# Other Bituminous Specifications

- 2353 Ultra-Thin Bonded Wearing Course
- 2354 Micro-Surfacing
- 2355 Bituminous Fog Seal
- 2356 Bituminous Seal Coat
- 2363 PASSRC and PASB
- 2365 Stone Matrix Asphalt (SMA)



# MnDOT Bituminous Office Website



The screenshot shows the MnDOT Bituminous Office Website. The header features the MnDOT logo and the text 'DEPARTMENT OF TRANSPORTATION' on the left, and a '511' logo on the right. Below the header is a green navigation bar with links for 'Search', 'MnDOT A to Z', and 'General Contacts'. The main content area is titled 'Bituminous Engineering' and includes a sub-navigation bar with 'Materials Home', 'Bituminous Home', and 'Contacts'. The 'Bituminous Home' section is active. It contains three main areas: 'What we do', 'Subject areas', and 'Combined States Binder Group'. The 'What we do' section describes the Bituminous Unit's role in providing leadership and assistance to agencies, contractors, and consultants. The 'Subject areas' section lists various topics, with 'Bituminous Manual' and 'Prepaving Meeting Document' circled in red. The 'Combined States Binder Group' section provides information about the MnDOT ftp site and lists links for 'Announcement Letter' and 'Data Report Sheet (Correct PAV Temperature, 100C)'. The 'Due date: 01/17/2020' is also mentioned.

**m** DEPARTMENT OF TRANSPORTATION

511

Search MnDOT A to Z General Contacts

## Bituminous Engineering

Materials Home Bituminous Home Contacts

### What we do

The Bituminous Unit provides leadership and assistance to agencies, contractors, and consultants on specifying, constructing and maintaining long lasting bituminous pavements.

### Subject areas

- [Bituminous Manual](#)
- [Quality Management \(QC/QA Worksheets\)](#)
- [Design](#)
- [Mix Design](#)
- [Plant Resources](#)
- [Street Resources](#)
- [Pavement Smoothness](#)
- [Prepaving Meeting Document](#)
- [Preventive Maintenance](#)
- [Research](#)
- [MnDOT Standard Specifications](#)
- [Special Provisions](#)
- [Materials Control Schedule](#)
- [Bidding](#)

### Combined States Binder Group

The MnDOT ftp site being used for document distribution is no longer available. This section is being used as a temporary home for distributing CSBG information while other means are being worked on.

Round Robin 2019-3 Information:

- [Announcement Letter](#)
- [Data Report Sheet \(Correct PAV Temperature, 100C\)](#)

Due date: 01/17/2020

<https://www.dot.state.mn.us/materials/bituminous.html>

## MNDOT BITUMINOUS MANUAL



*Curt Turgeon*

**MnDOT Pavement Engineer**

Digitally signed by Curtis Turgeon  
Date: 2019.04.05 08:57:26 -05'00'

**Date**

# MnDOT Pre-Paving Meeting Document

## Pre-paving Meeting

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### Bituminous Paving

Bituminous Materials Unit

3/20/2017

<https://www.dot.state.mn.us/materials/bituminousdocs/Prepaving%20Meeting%20Document%203-20-2017.pdf>



## MNDOT PAVEMENT PRESERVATION MANUAL



[https://www.dot.state.mn.us/materials/pavementpreservation/manualsandguides/documents/MnDOT Pavement Preservation Manual 2019 signed.pdf](https://www.dot.state.mn.us/materials/pavementpreservation/manualsandguides/documents/MnDOT_Pavement_Preservation_Manual_2019_signed.pdf)



# Mixture Selection

- Traffic Levels
  - AADT, ESAL's
- Traffic Type
  - Fast, Slow

## Design Criteria 2360

Rev. 03/06/2018

Mixture Designation Code	
Mixture Course	Code Format
Non Wear (4" below pavement surface)**	SPNW (1)* (2)* 30 (3)*
Wear (Top 4" of pavement)**	SPWE (1)* (2)* 40 (3)*
Shoulder Wear & Non-Trunk Highway Low Volume Wear	SPWE (1)* (2)* 30 (3)*
Stone Matrix Asphalt (SMA) – Spec 2365	SMWEE640H

\* Select (1) Aggregate Size; (2) Traffic Level; and (3) Asphalt Binder Grade as shown below. See

Mixture Designation Example. WE=wear; NW=non-wear

\*\*May replace 4" with 3" for non-trunk highway with traffic levels < 3 million ESAL's.

### (1) Aggregate size. Recommended minimum lift thickness is also shown:

Size A (-1/2") SP 9.5 – 1 1/2" minimum

Size B (-3/4") SP 12.5 – 2" minimum

Size C (-1") SP 19.0 – 3" minimum

Size D (-3/8") SP 4.75 – 3/4" minimum

- a. The **A** gradation provides a "finer" pavement surface. Select this aggregate size if you are concerned about coarseness of the driving surface or segregation of material during placement. It is only necessary to specify **A** for the final wear lift, aggregate size **B** can be used for all underlying lifts. Except for SMA and unless otherwise designated in the Special Provisions, the Contractor has the option to supply recycled mixture. With the approval of the Engineer, the Contractor may supply a gradation with a smaller maximum aggregate size than that specified, i.e. size A in lieu of size B.

### (2) Traffic Level: Select Levels 2-6 based on ESAL's as shown in example below.

- a. For slow traffic consider selecting a higher mix type (Traffic Level) and/or higher high temperature binder grade. For shoulders where traffic is allowed consider selecting a higher mixture type (Traffic Level).
- b. Use the same Traffic Level for Wear and Non-Wear mixture.

### (3) Asphalt Binder Grade:

- a. For mainline paving select the asphalt binder grade from the most current PG Guidelines. See Design Section on Bituminous Office Webpage.
- b. For shoulders where traffic is allowed, generally, use the same binder grade as the mainline.
- c. For shoulders where traffic is prohibited select either PG 52S - 34 or PG 58S - 28 by matching the mainline low PG number.  
**I.E. Mainline PG 58H - 28 → Shoulder PG 58S - 28**
- d. For new construction including cold in-place recycle (CIR), reclaiming, and reconstruction, specify, PG 58\_-34 in the wear (top 4") of the pavement structure.

Notes: 1) Typical Sections should delineate individual lifts/courses and thicknesses.

2) Include mixture designation codes and ride equation in contract special provisions.

3) Use SMA on final wearing surface only (1.5"-2" lift). Specify minimum PG 58V-28 (H) for SMA mixtures.

Mixture Designation Example: **SPWEB440E**

[https://www.dot.state.mn.us/materials/bituminousdocs/Bituminous%20-%20Design/Design%20Criteria%20March%202018\\_Chart.pdf](https://www.dot.state.mn.us/materials/bituminousdocs/Bituminous%20-%20Design/Design%20Criteria%20March%202018_Chart.pdf)

# Binder Selection

- Asphalt Binder
- New (re-construct)
  - PG 58H-34 Letter Grade “C”
- Overlay (mill & overlay)
  - PG 58S-28 Letter Grade “B”

November 12, 2015

## MnDOT PG Binder Guidelines-MSCR

The new PG designations are different from the previous asphalt binder specification. Following AASHTO M332 (MSCR) the New PG grading designations for Minnesota will all be PG58, followed by traffic loading designation and minimum pavement design temperature. For example: PG58S-XX, PG58H-XX, PG58V-XX, and PG58E-XX.

S, H, V or E grade designations must be specified for standard, high, very high or extremely high traffic loading, respectively.

Type of Construction	Recommended Asphalt Binder for < 3 Million ESALs (20 yr)	Recommended Asphalt Binder for 3 - 10 Million ESALs (20 yr)	Recommended Asphalt Binder for > 10 Million ESALs (20 yr)
Overlay Wearing Mixture (Top 4") <sup>3</sup>	PG 58S-28	PG 58S-28 <sup>1</sup>	PG 58H-28 <sup>1</sup>
New Construction <sup>2</sup> Wearing Mixture (Top 4") <sup>3</sup>	PG 58H-34	PG 58H-34 <sup>1</sup>	PG 58V-34 <sup>1</sup>
All Non-Wear Mixture (Below 4" from Surface)	PG 58S-28		

Recommended Binder Grade for Shoulders:		
With Traffic	With No Traffic	Next to Concrete Mainline and Concrete Curb and Gutter
Generally, use the same binder grade as the mainline, but, not to exceed PG 58H-XX.	PG 58S-28 or PG 52S-34 (match the mainline low PG number)	PG 58S-28 or PG 58H-28

**NOTES:** When varying from these guidelines or for further clarification, consult the MnDOT Bituminous Office.

<https://www.dot.state.mn.us/materials/bituminousdocs/Bituminous%20-%20Design/PG%20MSCR%20Guidelines%20Final.pdf>

# Minimum Lift Thickness

## Aggregate Size vs. Recommended Minimum Lift Thickness

Aggregate Size		Recommended Minimum Lift Thickness*
• Size A (-1/2") SP 9.5	→	1 ½" Minimum
• Size B (-3/4") SP 12.5	→	2" Minimum
• Size C (-1") SP 19.0	→	3" Minimum
• Size D (-3/8") SP 4.75	→	3/4" Minimum

\* Based on ratio of 1:3

# Wearing Course Aggregate Size

- Consider “A” (-1/2”) gradation for final lift
  - Finer mixes are a little easier to compact
  - Less prone to segregation
  - Will make a better joint than coarser mixes
- “A” can be used on all traffic levels.

# Verification Sampling Changes

- FHWA Quality Review Summary
  - MnDOT needs to be present and take immediate possession of sample after it is taken.
  - MnDOT needs to test all QA samples for that day when Agency/Industry results are out of tolerance.

# Sample Splitting

- The inspector must witness:
  - Sampling, and
  - Splitting
- The inspector must take possession of each sample after it is split.



# Compaction Methods

- Maximum Density Method (specification default)
  - Random coring locations.
- Ordinary Compaction
  - No cores are cut. Develop control strip (rolling pattern).





# “Effect of Compaction on Asphalt Concrete Performance”



Each 1% increase in air voids (over 7 percent) tends to produce ~10 percent loss in pavement life (~1 year less life)



# When do we Stop Production

- Stop Production if:
  - If all the lots in a day's production fail
  - Or if greater than 50% of lots on multiple days fail



# STREET INSPECTORS DUTIES

- Check bases for soft spots and cross slopes.
- Observe tack placement, need total coverage.
- Read specs and special provisions
- Check for segregation from trucks or pavers.
- Monitor temperatures.
- Check mat for tears, marks or bumps.
  - If any of these are bad check with a straight edge.

- [illegible]

# Field Documentation

- Emulsion Bills of Lading
- Core Stationing Worksheet
- Core Incentive/Disincentive Worksheet
- Pavement Smoothness Files (\*.PPF files)
- Pavement Smoothness Worksheet
- Street Diary
- Emulsion Lab Results
- Asphalt Binder Lab Results



# Small Quantity

If there is less than 300 tons of mix for an entire project, it can be accepted without sampling and testing, but must be documented with form 2403 or 02415.

## Spec 2360.2.G.5 Production Test Requirements

During production, the Department will not require mixture volumetric property tests if mix production is no greater than 300 tons.

Provide production tests if the accumulation exceeds 300 tons.

# Ultra-Thin Bonded Wear Course (UTWBC)

- **Durable wearing surface**
- **Has been used on poor pavements to hold them together**
- **Can be used over concrete**
- **Versatile mix, has shown outstanding performance**





# Ultra-Thin Bonded Wear Course (UTWBC)



Spray Paver



Open Texture

# UTBWC Case Study

- Holding together a deteriorated concrete road



2012:  
Before



2013:  
After



2019: Current

# Segregation

Segregation is defined as the separation of the sand from the rocks in the mix. It affects the long term pavement performance and is a result of mishandling of the mix. Segregation can occur at:

- Production (silo and stockpiles)
- Delivery – Truck Loading and Unloading
- Paver





# Segregation



# Slight Segregation



Mastic in place between aggregate particles, slightly more coarse in appearance

**Corrective Action** – Typically accepted



# Medium Segregation



Significantly more coarse aggregate than surrounding mat and lack of surface mastic

**Corrective Action** – Generally left in place for lower lifts however surface coarse is subject to price adjustment, remove and replacement, or resurfacing at the contractors cost.

# Severe Segregation



Appears very coarse, with stone against stone, and little or no mastic

**Corrective Action** – Often the pavement will be removed and replaced across the full lane in a workman like manner or covered with acceptable mix at the contractor's cost.



# 2360 Specification Requirement



1/4 inch across a 10 foot straight edge centered on the joint

Correct by diamond grinding or Remove & Replace

Not segregated, open or torn

Source: Table 2360-27, "Surface Requirements"

# Factors that Affect the Screed

- Head of Material
- Paving Speed
- Screed Adjustment
- Mix Design
- Mix Temperature
- Air Temperature
- Base Temperature





# 1501: Authority of the Engineer

- The Engineer will, in the Engineer's sole discretion, decide all questions regarding:
  - (1) Quality and acceptability of Materials provided and Work performed,
  - (2) Manner of performance and rate of progress of the Work,
  - (3) Interpretation of the Contract,
  - (4) Measurement, control of quantities, and the amount of any payment deductions or adjustments, and
  - (5) Acceptable fulfillment of all Contract provisions on the part of the Contractor.

# 1504: Coordination of Contract Documents

## Order of precedence:

- (1) Addenda,
- (2) Special Provisions,
- (3) Project-Specific Plan Sheets
- (4) Supplemental Specifications
- (5) Standard Plan Sheets and Standard Plates
- (6) Standard Specifications

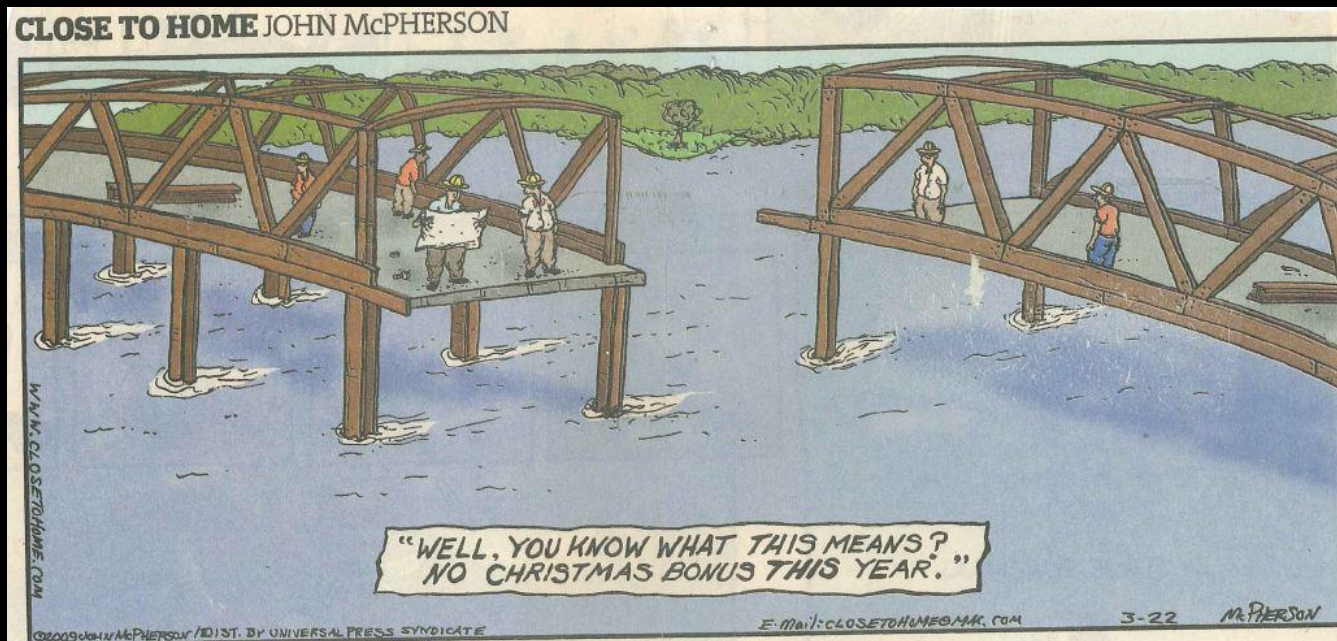


# 1511: Authority of the Inspector

- Inspectors have the authority to do the following:
  - (1) Inspect the Work and the preparation, fabrication, or manufacture of Materials;
  - (2) Notify the Contractor of non-conforming Work;
  - (3) Reject non-conforming materials; and
  - (4) Suspend portions of the Work for the following reasons that require a decision by the Engineer:
    - (4.1) Interpretation of requirements in the Contract,
    - (4.2) Use of unapproved material, or
    - (4.3) Safety.
- Inspectors do not have authorization to alter or waive requirements of the Contract or to issue instructions contrary to the Contract

# 1512: Unacceptable and Unauthorized Work

The Department will consider all Work and Materials that do not meet the Contract requirements to be unacceptable.





# Workmanship





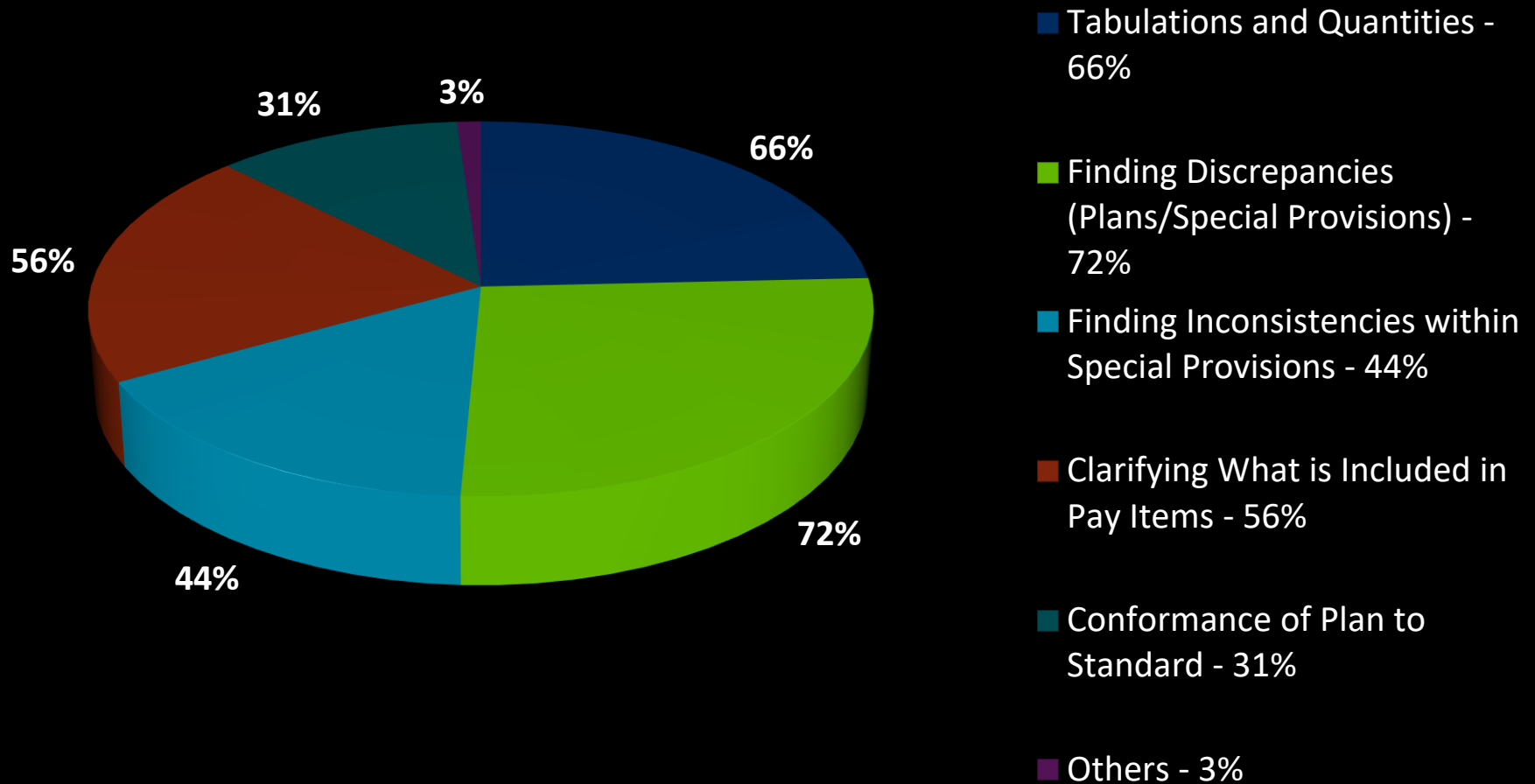
# Industry Interview on Quality of Bidding and Plans

(from Mn/DOT Office of Construction and Innovative Contracting)

- Where is the breakdown in the bidding process?
  - Design was most commonly mentioned
  - Quantity errors were cited as a common problem



## #15 - What Are the Key Areas in the Construction Contract Docs That You Believe MnDOT Should be Checking Prior to Advertising Projects?



# Thank you!

## Have a Safe and Productive Season

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2/13/2020